グローバルＣＯＥ地球惑星科学
フロンティアセミナー

アラスカにおける現在の変動場と応力速度

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講義内容 ：

The subduction of the Pacific Plate beneath North America induces broad scale stressing of the Alaskan crust that has led to the development of the highest mountains in North America, the highest slip rates along some of the longest strike-slip faults on Earth, and widespread seismicity that includes the 1964 M9.2 Alaska earthquake, the second largest ever recorded. These features are a consequence of deformation associated with three primary processes, interseismic loading due to subduction of the Pacific slab, large earthquakes, and postseismic relaxation of a viscous lower crust and mantle. How these mechanisms contribute to the contemporary deformation and stressing rates in the Alaskan crust is not well understood. Here we use two GPS velocity fields, one observed prior to the M7.9 2002 Denali earthquake and observed after, to constrain a 3-D viscoelastic finite element model of the relevant mechanisms to gain insight into how these processes are shaping Alaska today.

Model results suggest that prior to the 2002 Denali earthquake, the velocity field was controlled by interseismic motion of the converging plates as well as on-going postseismic deformation within the upper mantle following the 1964 earthquake. That postseismic relaxation remains so significant more than 4 decades after the event—it continues to drive velocities to the south despite northward plate convergence—is a testament to the importance of this process. Results also suggest that the lithosphere south of the Denali fault (accreted terranes) is weaker than that to the north, leading to the extrusion of material to the west. Following the 2002 Denali earthquake, the velocity field is dominated by postseismic relaxation in the mantle below ~50 km, confirming that this plate boundary is characterized by a thin lithosphere comprised of a strong upper and lower crust along with a thin mantle lid. Asymmetry in the pattern of postseismic deformation further reveals the weakness of the lithosphere south of the Denali fault compared to that of the north. We suspect this is associated with hydration associated with the subducting slab or a general weakness in the accreted terrains. Model results show how subduction of the Pacific plate induces both compression and shear in the overriding North American plate. In addition, the process of postseismic relaxation is shown to reload ruptured surfaces as well as neighboring fault segments. Such loading can induce stress triggering of other earthquakes and lead to earthquake sequences.

主　催 ： 東北大学 グローバルCOEプログラム
『変動地球惑星学の統合教育研究拠点』
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